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## ABSTRACT

The responses of young children to two forms of the Sampling Organization and Recall Through Strategies (SORTS) test were compared. Subjects were first, second, and third graders in a Midwestern urban area. Children's SORTS scores, representing the sorting skill levels demonstrated by the children, were derived from a combination of groups formed by the children, their stated reasons for these groups, and experimenter's judgments of their grouping strategies. Scores corresponded to four strategy levels: (1) syncretic strategies, (2) perceptual strategies, (3) low associative strategies, and (4) superordinate and categorical strategies. Results indicate no differences in the scores from two forms of the SORTS test on any of the variables explored. (Author/BJG)

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SCOPE OF INTEREST NOTICE

RELIABILITY OF CHILDREN'S SORTING STRATEGIES  
USING ALTERNATE FORMS OF THE SORTS TEST

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## RESEARCH REPORT #68

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RELIABILITY OF CHILDREN'S SORTING STRATEGIES  
USING ALTERNATE FORMS OF THE SORTS TEST

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August 1974

The research reported herein was performed pursuant to a grant from the Bureau of Education for the Handicapped, U. S. Office of Education, Department of Health, Education, and Welfare to the Center for Research, Development and Demonstration in Education of Handicapped Children, Department of Special Education, University of Minnesota. Contractors undertaking such projects under government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official position of the Bureau of Education for the Handicapped.

Department of Health, Education and Welfare  
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Bureau of Education for the Handicapped



**RESEARCH AND DEVELOPMENT CENTER  
IN EDUCATION OF HANDICAPPED CHILDREN**  
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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

## Reliability of Children's Sorting Strategies

### Using Alternate Forms of the SORTS Test

R. Hunt Riegel

Perhaps the most efficient methods used by children in learning new information consist of either the identification or generation of associative relations between two or more stimuli in their environment. The types of relations typically identified, however, have been found to vary with age in consistent ways. Qualitative differences have been observed by numerous researchers to progress from relatively simple motoric responses such as manipulation of objects for the sake of manipulation, through responses based on perceptual characteristics of objects such as color, size and shape, and ultimately to classifying responses based on functional attributes of objects which must be inferred by the child, such as the use to which they may be put (cf., Riegel, Danner and Donnelly, 1973; Piaget and Inhelder, 1964; Bruner and Olver, 1963).

An instrument designed to assess the types of relations utilized by children between the ages of 5 and 9 has been used extensively by this writer to study the development of, and effects of training on, the utilization of associative relations between pictures of objects in young educable mentally impaired children and in non-impaired children (Riegel, 1972; Riegel, Taylor & Danner, 1973; Riegel, Taylor, Clarren & Danner, 1973; Riegel and Taylor, 1974). In addition, the effects of the relations generated by children on their subsequent recall of those items has been explored, both in terms of the total resultant recall and the organization

of the items recalled (i.e., clustering). This instrument, the Sampling Organization and Recall Through Strategies (SORTS) test (Riegel, 1973) has been used for both pretest and posttest data. Although differences were found between experimental and control groups using the same test items at both pretest and posttest, the need for an alternative form of the instrument is evident. Such an alternative has now been developed and pilot tested. The purpose of the present study is to compare the responses of young children to the two forms of the instrument in order to assess the alternate-form reliability of the measure.

#### METHOD

Subjects. The subjects for this study were children in a Midwestern urban area. Fourteen children were randomly selected from first, second and third grade regular classrooms.

Procedure. Subjects within grade levels were randomly assigned to one of two conditions. In the first group, children were given Form I of the SORTS Test, followed by Form II. In the second group, this order was reversed. Testing was conducted individually. Each form of the test required approximately 15 minutes to administer.

Instrumentation. Procedures described in the SORTS Manual (Riegel, 1973) were followed for both forms of the test; children were first given a warm-up sorting task in which they were to put a set of 12 pictures



into piles the way they thought best, and their reasons for each pile were recorded. Following this, a test set of 20 items were similarly presented, with the instruction to "put the pictures together in piles so that you can remember them" (Sort 2). After sorting the cards, the children were asked to remember as many of the items as they could, and again their reasons for their groupings were recorded. This constituted the basic procedure for assessing subject-generated grouping responses. A second test procedure using examiner-generated groupings followed the above immediately. The examiner regrouped the same items into conventional categories (described below), and asked the subjects to tell why they thought the pictures were put together in that way (Sort 3). Recall was then requested a second time. This ended the first test administration. After a brief rest period the alternate form (i.e., the second set of test pictures) was administered using the same procedures.

Items selected for inclusion in each test set conformed to the following criteria:

1. They were pictures of common inanimate objects for which the subjects could supply a name.
2. They could be grouped in a variety of meaningful ways including "conventional" categories.
3. Each item was colored either red, yellow, blue, or white such that no two items in the same category were of the same color.

The items, and their category descriptors, although presented in an array in which no two category members were adjacent, are presented on the following page by category for comparison.

## Form I

Things that grow

FLOWER  
BANANA  
LEAF  
CORN 6

Things that make noise

BELL  
DRUM  
WHISTLE  
HORN

Furniture

BED  
DESK  
TABLE  
ROCKING CHAIR

Things to ride in

BOAT  
AIRPLANE  
BICYCLE  
BUS

Things to live in

HOUSE  
BARN  
TEEPEE  
BIRD HOUSE

## Form II

Things to wear

SHIRT  
SHOES  
HAT  
DRESS

Things to play with

DOLL  
PUZZLE  
BALL  
BLOCKS

Furniture

TABLE  
ARMCHAIR  
DESK  
BED

Things used for eating

CUP  
GLASS  
SPOON  
KNIFE

Buildings

HOUSE  
GARAGE  
STORE  
CHURCH

Three indices of performance were analyzed for each form of the test, a summary of which follows:

The Sorting level index. This score represents the sorting skill level demonstrated by the child, and is derived from a combination of the groups formed by the child, his stated reasons for those groups, and the experimenter's judgment of the grouping strategy employed. Each group formed is assigned a value according to the specifications in the SORTS coding key (see Administration and Scoring Manual, Riegel, 1973), and yields a score for each child which corresponds to one of the following four levels of grouping:

Level 1: Syncretic strategies. Groups at this level reflect a general failure to generate relations between items on the basis of an attribute or set of attributes. Grouping items by their spatial contiguity ("because they were next to each other") or subordinating the sorting task to an unrelated manipulative operation ("I wanted to make a square with the pictures") are examples of this level. Also included are instances of no strategy for grouping at all, such as the case of a subject simply pulling all items into a single pile or not moving them at all.

Level 2: Perceptual strategies. The groups at this level are based on similarities of color, shape, or size (e.g., "they are all red"). Sorting by perceptual characteristics indicates a basic understanding of grouping by similarities with a lack of attention to more meaningful attributes of the items.

Level 3: Low associative strategies. This level refers to groups which are formed on the basis of meaningful attributes of items. Groups formed by creating a story about the items, those based on similar parts (e.g., "They all have feet"), and those based on chains of associations are examples of level three strategies.

Level 4: Superordinate and categorical strategies. Groupings at this level include superordinate groupings in which all items in a group are subsumed under a single intrinsic attribute or attribute set. Examples of groupings at this level include groups based on items having similar function (e.g., they all are for eating; you can live in them) or on category membership (e.g., they are furniture).

A separate coding key, analogous to the first, but modified to account for the different task requirements, was used to score responses to the examiner-generated groupings (Sort 3).

The Recall Score. The second index is the total number of correctly recalled items in Sorts 2 and 3 obtained by simple counting of verbatim protocols. Repetitions and intrusions are not included in the recall score.

The Clustering Index. Clustering in recall is assumed to be a reflection of covert organizing operations by the subject. The clustering index used with the SORTS test indicates whether or not a subject tends to recall items in the same groups as those which he had earlier generated or seen. The index has been adapted from Frankel and Cole (1971) and consists of a z score which is computed for each subject based on his sorting and recall. Those subjects whose z score exceeds 1.96 are judged to be significantly clustering their recall. Thus, in Sort 2, a z greater than 1.96 indicates that the subject's recall organization corresponds to his sorting organization. In Sort 3, a z greater than 1.96 indicates that the subject's recall organization corresponds to the experimenter's sorting organization.

## RESULTS

Comparisons were made on sorting and recall scores between the groups given Form I and Form II on the first administration of the SORTS test, and again on scores from the second administration. Table 1 presents the mean sorting and recall scores for the first administration of Sort 2 for each group within each grade level, and combined across the entire sample. No significant differences were found between the group given Form I and the group given Form II at any of the three grade levels, on either sorting performance or recall in Sort 2 (the subject-generated grouping task). There were also no differences between the mean scores on either variable when combined across grade levels.

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Insert Table 1 about here  
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When presented with examiner-grouped categories, many of the children were able to identify associative relations between the items, but again no differences were found between scores on the two forms of the test for groups at all three grade levels, as well as between scores for the combined groups. Table 2 presents these data.

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Insert Table 2 about here  
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Similarly, the two forms of the SORTS test yielded comparable results when subjects were asked to identify relations and recall items from the examiner-grouped items. No differences were found between the scores from the two forms in either identification or recall in Sort 3. Table 4 summarizes the findings from this task.

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Insert Table 4 about here  
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Comparisons of scores between the two forms of the test, regardless of order of presentation, showed no differences between the two forms. Mean scores for each variable are presented in Table 5.

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Insert Table 5 about here  
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There were no differences in the proportion of children clustering their recall on the two forms of the test. While 44% of the children clustered during recall from their own groupings (i.e., in Sort 2) on Form I, 39% clustered on Form II. In recall of the examiner's groupings (Sort 3), 73% clustered on Form I while 87% clustered on Form II.

In addition to the above comparisons, correlational analyses were run on each child's scores from the two forms of the test. The rank-order coefficient for sorting level scores on Sort 2 was .53 ( $p < .01$ ), while that of Sort 3 was .90 ( $p < .001$ ). Pearson coefficients for recall on the two forms were .55 ( $p < .01$ ) for Sort 2, and .64 ( $p < .01$ ) for Sort 3.

#### DISCUSSION

The results of this study showed no differences in the scores from two forms of the SORTS test on any of the variables explored. It is apparent that the two sets of pictures do not inherently elicit significantly different grouping or mnemonic strategies in young children. Given the constraints

on the stimulus items (i.e., pictures of concrete, familiar objects; color; size; categories represented), children tend to persevere in the manner in which they approach the task of organizing and remembering information. These results lead us to the conclusion that the two forms of the SORTS test do indeed yield comparable results, and may be used in future inquiry as alternate forms.

In addition to this conclusion, evidence may be found in support of previous conclusions that sorting, recall and clustering performance increase consistently with age (Riegel, Danner and Donnelly, 1973). While no differences were found between scores on Form I of the SORTS test and scores on Form II within any of the three grade levels tested, consistent trends toward higher levels of sorting, higher recall, and more children clustering were observed as grade level increased. It appears that the two forms of the SORTS test are consistent both in yielding similar results within age levels, and in reflecting similar developmental changes in sorting and mnemonic performance.

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Table 1. Mean sorting and recall scores for Sort 2  
(Self-generated groupings): First administration

	Sorting Scores		Recall	
	Form I	Form II	Form I	Form II
Gr. 1 (s.d.)	2.01 (0.71)	1.47 (0.60)	6.57 (2.15)	4.86 (2.04)
Gr. 2 (s.d.)	2.14 (1.35)	2.26 (1.04)	6.86 (2.34)	8.57 (2.82)
Gr. 3 (s.d.)	2.33 (0.83)	2.55 (1.22)	9.0 (2.83)	10.86 (2.27)
Combined (s.d.)	2.16 (0.96)	2.09 (1.05)	7.48 (2.58)	8.10 (3.40)

Table 2. Mean sorting and recall scores for Sort 3  
(examiner-generated groupings): First administration

	Sorting Scores		Recall	
	Form I	Form II	Form I	Form II
Gr. 1. (s.d.)	2.71 (1.45)	2.97 (0.71)	8.86 (2.97)	10.00 (3.37)
Gr. 2. (s.d.)	2.94 (1.26)	3.43 (0.77)	8.57 (2.57)	10.43 (2.51)
Gr. 3. (s.d.)	3.86 (0.30)	3.66 (0.57)	11.00 (3.06)	11.29 (2.43)
Combined (s.d.)	3.17 (1.18)	3.35 (0.72)	9.48 (2.94)	10.57 (2.99)

Table 3. Mean sorting and recall scores for Sort 2  
(self-generated groupings): Second administration

	Sorting Scores		Recall	
	Form I	Form II	Form I	Form II
Gr. 1 (s.d.)	2.37 (0.87)	1.99 (0.80)	6.57 (1.98)	7.57 (2.99)
Gr. 2 (s.d.)	2.42 (0.90)	2.51 (1.13)	8.00 (2.38)	6.86 (2.04)
Gr. 3 (s.d.)	3.51 (1.11)	2.95 (1.19)	9.86 (2.48)	10.43 (4.39)
Combined (s.d.)	2.76 (1.06)	2.51 (1.08)	8.14 (2.89)	8.29 (3.49)

Table 4. Mean sorting and recall scores for Sort 3  
(examiner-generated groupings): Second administration

	Sorting Scores		Recall	
	Form I	Form II	Form I	Form II
Gr. 1 (s.d.)	3.06 (0.99)	2.69 (1.22)	7.86 (2.73)	7.43 (3.91)
Gr. 2 (s.d.)	3.51 (0.72)	3.03 (1.15)	12.29 (2.29)	11.29 (1.89)
Gr. 3 (s.d.)	3.80 (0.38)	3.93 (0.19)	12.28 (2.69)	10.71 (3.09)
Combined (s.d.)	3.46 (0.77)	3.21 (1.07)	10.81 (3.25)	9.81 (3.40)

Table 5. Mean sorting level and recall scores for Form I and Form II independent of order of presentation (N=42)

	Sorting Scores		Recall	
	Form I	Form II	Form I	Form II
Sort 2 $\bar{X}$ (s.d.)	2.45 (1.04)	2.31 (1.09)	7.81 (2.73)	8.00 (3.30)
Sort 3 $\bar{X}$ (s.d.)	3.29 (1.04)	3.29 (0.94)	10.14 (3.14)	10.69 (3.29)

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